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three young birds found in the willows and cottonwoods thinly skirting the South Fork of the Smoky Hill river.

Buteo borealis krideri Hoopes. Krider's Hawk. Killed a female; think I saw another bird, but am not positive, as they so closely resemble at a distance the light phase of *Archibuteo ferrugineus*.

"BIRDS RARE IN THE STATE."

Myiadestes townsendi (Aud.) Caban. Townsend's Solitaire. Saw ten; shot four of the birds.

Dendroeca auduboni (Townsend) Baird. Audubon's Warbler. Shot several; quite common.

Corvus cryptoleucus Couch. White-Necked Raven. Saw a flock of six and one of seven birds; shot three.

I have specimens of the above birds in my collection.

I rejoice to know that we are at last to have a standard classification and nomenclature, as it will in the future do away with the present confusion in arrangements and of names. I shall, in accordance with same, issue a new edition of my Catalogue of the Birds of Kansas.

A CLASS-ROOM EXPERIMENT ON EBULLITION.

BY EDWARD L. NICHOLS, PH. D., OF THE STATE UNIVERSITY.

The change of volume of water between 0° and the boiling-point has been very carefully studied. It is most conveniently expressed by means of the well-known curve, in which the abscissæ are temperatures, and ordinates represent the volumes. Beyond the boiling-point, however, the curve varies with the conditions of the experiment. If boiling takes place without superheating, the change of volume of the liquid and vapor is represented by a vertical line; but if the water be superheated before ebullition occurs, the curve takes a form not yet fully determined.*

Of the behavior of a superheated liquid we know but little aside from the fact shown in Dufour's† and in Donny's‡ well-known experiments, that the temperature may be raised many degrees above the normal boiling-point without ebullition. Those experimenters have shown, what indeed we should expect from the nature of the process of ebullition,§ that in order to prevent boiling it is necessary to have expelled all gases from the body of the liquid. In Dufour's experiment this condition is attained by suspending a globule of previously boiled water in a mixture of olive oil and the oil of cloves, the proportions being such as to give a density to the mixture just equal to that of water. In this way water has been heated to 178° without boiling; and when ebullition does take place the tension of the vapor is sufficient to produce a considerable explosion, sometimes blowing the hot oil from the bath with violence. Donny's method of excluding the air consists in boiling the water in one end of a long and doubly-bent tube; after which, without stopping the ebullition, the other end is sealed in the blast-lamp. In such a tube water may be heated to about 130°, at which temperature explosive boiling takes place, and the tube is generally shattered.

For the purpose of illustrating this interesting phenomenon to his classes, the writer has made use of the following very simple device. In a small "U" tube with unequal

* Upon this point see James Thomson—Proceedings of British Association, 1871; also, Maxwell's Theory of Heat.

† Bibliothèque Universelle—Archives, 1861, vol. XII.

‡ Annales de Chiune, 3d series, vol. XVI, 1871.

§ E. L. Nichols—Proceedings of the American Association, 1881; also, Maxwell's Theory of Heat.

arms, the shorter arm of which is sealed, a small quantity of water is placed. A column of mercury is introduced next, to separate the water from the outer air, this column being of such length as to bring the water under a total pressure of a few millimeters less than one atmosphere. If the tube thus filled be placed in a bath of boiling water, the water within the tube will boil, and the mercury will be driven outward until it stands at the same height in both arms of the tube, or until the vapor formed has reached its maximum tension. At the same time a small bubble of air will be excluded from the boiling water, which upon cooling can be removed from the tube. If this process of boiling, cooling, and expelling the excluded bubble of air, be repeated until on further boiling no bubble is formed, the water will finally refuse to boil when the tube is placed in the water bath; and in the oil or paraffine bath it can be heated to 130°, as in Donny's experiment, without ebullition. At this temperature vapor is suddenly formed, and the mercury is violently expelled from the tube.* The apparatus then only needs refilling to be ready for a repetition of the experiment.

The writer hopes, with the aid of this very simple apparatus, to make a more detailed study of the superheating of various liquids, and of the attendant phenomena, than has been possible hitherto.

THE UTILIZATION OF MINERAL WATERS.

BY E. H. S. BAILEY.

There has been for the past few years a growing interest in the subject of the purity of water supply. Whether for municipal supply, for boiler purposes, for use in manufacturing, or for domestic use, people begin to realize that certain constituents are dangerous, others of no use, and others detrimental. It is difficult to draw the line sharply between potable waters and so-called mineral waters. If we attempt to put a maximum limit to the solid residue that a potable water shall contain, there are numerous mineral waters, acknowledged to be of value, that do not contain a tenth the amount. Again, very hard waters are often richer in mineral constituents than the so-called mineral waters. A mineral water, then, may be defined as one containing an abnormal amount of solids, or containing some unusual constituents. Chalybeate, Borax and Lithia springs belong to the latter class. It often occurs that waters, like those of many of the Saratoga springs, contain 800 to 1,000 grains of solid matter per gallon, and also comparatively rare elements, such as Bromine, Iodine, and Lithia.

Water, the great solvent, has taken into solution—has selected, so to speak, from the variety of material through which it has flowed—certain substances. Though we may make artificial mixtures closely resembling the natural, it is found difficult to exactly imitate nature. An interesting case was up for consideration a year or two ago in the United States Department of Customs. It seems that natural waters are admitted free of duty, while artificial waters are taxed. The Apollinaris Company were anxious to import duty-free; but it was shown by chemical experts that the spring water was salted and surcharged with carbonic acid gas before being bottled, and so became an artificial water. The Secretary of the Treasury, however, overruled the opinion of these experts, and of the Attorney General, and all duties were remitted, much to the disgust of those engaged in bottling American spring waters.

*The apparatus here described is given in some text-books on physics (see Dechanel's *Natural Philosophy*, part II), its object being to illustrate the tension of vapor formed when a liquid boils under atmospheric pressure. The behavior of the liquid when all air is expelled, as above described, seems not to have been observed.